REMARKS

INTRODUCTION

Claims 1-13 were previously and are currently pending and under consideration.

Claims 1-13 are rejected.

Claims 1, 2 and 13 are objected to.

Claims 1, 2, and 13 are amended herein.

No new matter is being presented, and approval and entry are respectfully requested.

PRIOR ART: HERNDON

Herndon discusses a system for detecting and picking up parts. The system is trained for a particular type of part to generate a description of the part/component in a manner which will allow the system to recognize the shape of the part and process that part (column 6, lines 31-35). The system is trained for the part by first a human operator placing a part flat on the backlit pickup zone. A fixed overhead camera takes an image of the part. A proposed silhouette from the image is displayed for the human operator, who edits the edges and corners of the silhouette (column 6, lines 58-66). Several different samples of the part/component are subjected to this imaging and editing process, to derive a statistical description of the silhouette component. This statistical or average silhouette of the part corresponds to the first data file mentioned at column 6, lines 36-40, and "allows matching of a silhouette image to its theoretical outline". In other words, for a given part/component, several images are taken and statistically averaged or combined to create a theoretical silhouette or profile of the part when lying flat.

The training for the part also requires the human operator to control the robotic manipulator arm to a position and orientation from which the robot can seize the component (column 7, lines 15-18). The difference between the starting and ending position and orientation of the robot becomes grip transformation data, which is stored in the second data file mentioned at column 6, lines 40-45.

The two data files for a particular part/component are used for picking up the part. First, the camera takes a picture of the component and attempts to recognize the component using

the first data file describing the component's shape or silhouette (column 7, lines 50-55). This initial stage is also described at column 8, lines 30-35, which mention the camera taking a picture to be used for locating a component on the backlit surface. The picture is processed to locate the position of the component and the orientation of the component on the backlit viewing zone.

A significant feature of Herndon is that a fixed camera and fixed viewing zone are used to capture silhouette images of parts lying flat ("a single layer of components to emerge from beneath the brush", column 1, lines 66-68; "components are dispersed into a single layer" column 2, lines 28-31; "vacuum-seize a component... lying on its side", column 2, lines 45-50; "the dispersed single layer of components 122 is viewed by camera 126 as a dispersed array of opaque (polygonal) shapes or silhouettes of the components", column 3, lines 65-68; and "the vibratory plate 104 is adjusted nominally to one and one/half times the thickness of the **component as it lays flat on the surface of the plate in a preferred natural orientation**", column 7, lines 35-42). Furthermore, the discussion of the component feed mechanism and the exemplary electronic circuit parts indicate that the Herndon operates under the assumption that the components are flat parts such as circuit boards.

This understanding is also supported by the construction of the pickup mechanism ("end effector 154") and axial cylindrical arm 153. The suction cup 201 can only be manipulated: (a) upwards and downwards to pick up parts (i.e. perpendicular to the pickup service); (b) pivotably from the vertical position of picking up on the backlit surface to a horizontal position where a tonged hand seizes the part from the upward-pivoted suction cup; and (c) rotationally about the axis of axial cylindrical arm 153 (presumably this is how pickup orientation is effected).

In view of the above, several traits of Herndon are apparent. First, Herndon does not store capture direction information (orientation information) when capturing an image during training. Not only does Herndon not explicitly disclose associating a capture direction with an image, but Herndon clearly does not need this information. Predetermined orientation information is not needed because when a fixed calibrated camera captures silhouettes of flat pieces, the orientation of those pieces/silhouettes is inherent in or determinable from the image itself. In other words, the silhouette's orientation in the image is the same as its orientation on the pickup surface, so no prestored orientation information is needed. The inherent orientation is used as a basis for applying the grip transformation to grip the part. Second, Herndon deals only with two-dimensional location and orientation information. A third dimension is not

disclosed or necessary.

OBJECTIONS TO THE CLAIMS

Claims 1, 2 and 13 were objected to because of informalities. Corrections are made herein. Withdrawal of the objection is respectfully requested.

REJECTIONS UNDER 35 USC § 102

In the Office Action, at pages 3-4, claim 13 was rejected under 35 U.S.C. § 102 as anticipated by Herndon. This rejection is traversed and reconsideration is requested.

CLAIM 13: HERNDON DOES NOT TAKE CAPTURE IMAGES ROBOTICALLY

Amended claim 13 recites "robotically taking images of a subject with different ... subject-camera arrangements". The rejection compares this feature to column 6, lines 26-49. However, this portion of Herndon reveals that "The system operator is required to prepare several typical samples of a component ... The system operator then places a sample component within the viewing zone ... The operator then edits the edges and corners ...". The Merriam Webster Online Dictionary indicates that "robotic" can mean "having the characteristics of a robot <performs with robotic consistency>". The image capture images in Herndon are not robotically taken. Withdrawal of the rejection is respectfully requested.

CLAIM 13: HERNDON DOES NOT STORE INFORMATION INDICATING SUBJECT-CAMERA ARRANGEMENT WHEN CAPTURING AN IMAGE

Claim 13 also recites taking images with different "subject-camera arrangements", and "associating with each image or data thereof information indicating its subject-camera arrangement" when taken. It is noted that an image data has associated with it information of the subject-camera arrangement with which the corresponding image was taken. The rejection compares this feature to column 6, line 50, to column 7, line 14 of Herndon. However, in Herndon, the part is placed randomly on the backlit surface by the operator, so the camera-workpiece arrangement can't be known and can't be associated with the image (column 7, lines 12-14). Furthermore, the rejection cites the first data file generation process of Herndon. The first data file is used for recognition of the component and its location, which is used to drive the

pick-up arm to the center of gravity of the silhouette. The "statistical description of the component" (stored silhouette) in the first data file is disclosed as being only for recognition of the component and no subject-camera arrangement is mentioned as being associated therewith. In fact, during training, after the image is captured, the camera is moved to the center-of-gravity of the silhouette, and is then oriented and moved by the operator to grip the part. The human operator's movement of the pick-up arm is the information used later to orient the pick-up arm for picking parts. The only information associated with the silhouette data (first data file) is the second data file. However, the second data file cannot be the recited subject-camera arrangement information at the time of capturing the image because it is only grip transformation information. Furthermore, the information in the second data file is based on information generated after the pick-up arm has been moved by the operator.

CLAIM 13: HERNDON IS TWO-DIMENSIONAL, NOT THREE DIMENSIONAL

Amended claim 13 recites "taking images of a subject with different three-dimensional subject-camera arrangements that vary in three dimensions" to ultimately "determine the three-dimensional orientation of the workpiece relative to the camera". As discussed above ("Prior Art: Herndon), in Herndon, the arrangements are strictly two-dimensional; a part is placed flat on a fixed surface below a fixed camera. No mention is made of three-dimensional features in Herndon.

Withdrawal of the rejection is respectfully requested.

REJECTIONS UNDER 35 USC § 103

In the Office Action, at pages 4-5, claims 1, 3, 4, and 8 were rejected under 35 U.S.C. § 103 as being unpatentable over Herndon in view of Suzuki.

At pages 6-7, claims 2, 5, and 6 were rejected under 35 U.S.C. § 103 as being unpatentable over Herndon in view of Suzuki in view of Werth.

At page 7, claim 7 was rejected under 35 U.S.C. § 103 as being unpatentable over Herndon in view of Suzuki in view of Werth and further in view of Ninomiya.

At pages 8-9, claims 9-12 were rejected under 35 U.S.C. § 103 as being unpatentable over Herndon in view of Kirsch.

These rejections are traversed below and reconsideration is requested.

SUZUKI DOES NOT STORE IMAGE CAPTURE DIRECTION

Claim 1, for example, recites "said robot is operated for positioning to a plurality of different image pickup positions and directions, so that the image data respectively obtained at each of said different image pickup positions and direction information indicating **the** respective different direction, is stored as a teaching model" (emphasis added). According to this portion of claim 1, "**the** respective different direction" indicated by the direction information (stored with the teaching model) is clearly one of the "plurality of different image pickup ... directions" to which the robot is operated. In other words, information of a taken image's pickup direction is stored with the image data picked-up/obtained from such pickup direction, to form a teaching model.

The rejection states that Herndon does not teach this feature. At item 15 of the Office Action, the rejection compares this feature to column 4, lines 32-39, and column 3, line 66 - column 4, line 9 of Suzuki. This comparison is incorrect because according to column 4 of Suzuki, the orientation (direction) information mentioned at lines 32-39 is orientation of parts relative to and as arranged in sample 10. Suzuki does not discuss or suggest storing direction information indicating a direction at which an image data's image was taken. A review, below, of the capture process of Suzuki confirms the conclusion that Suzuki stores orientation of parts in a sample, which is not information of an image pickup (capture) orientation.

The capture process begins at step W1, where images of sample 10 are captured from different directions (by moving the cameras or samples). This allows unseen portions of sample 10 to be imaged. The 2-d images are used as a basis to derive 3-d positions of vertexes/edges of sample 10. The discussion of step W1 does not disclose storing or even using the actual direction from which the 2-d images are captured.

At step W2, the 3-d positions of the vertexes/edges of sample 10 are sorted by height position (Z position) to obtain a layer outline (profile) of each layer of sample 10 of each height. Again, the discussion of step W2 does not disclose storing the direction from which the images of step W1 were obtained or picked up.

At step W3, different parts that belong in each layer are determined using the layer outlines of step W2 and pre-stored form data of each part of sample 10. There is no mention of information about a direction from which the images of step W1 were taken.

At step W4, the parts of each layer are actually arranged into a mathematical construction of sample 10. That is, step W4 "acquires part arrangement data including 3-dimensional positions and orientations of the parts included in sample 10 by using the part data of each height detected by [step W3]". This "part arrangement data [is stored] in construction data memory 21". The storing is step W5.

None of steps W1-W5 mention or suggest storing, for an image data produced by taking an image from a direction, direction information "indicating the respective different direction" from which the image data's image was taken. Furthermore there is no need to. Steps W1-W5 are steps of a construction recognizing circuit. Recognizing the construction of sample 10 does not in any way require storing information about capture directions of the images from which construction is recognized, rather, all that is needed are the "2-dimensional image data" (column 4, lines 7-8).

Withdrawal of the rejection is respectfully requested.

PRIMA FACIE CASE OF OBVIOUSNESS NOT MADE: NO MOTIVE TO COMBINE

A prima facie case of obviousness under 35 U.S.C. § 103 must include a prior art motive indicating why one in the art would desire to make the proposed combination or modification. The rejection of claims 1, 3, 4, and 8 (items 14 and 15 of the Office Action) do not include any such motive. There is no discussion of a suggestion in the prior art of why it would have been desirable to modify Herndon with Suzuki. A prima facie case of obviousness has not been made.

Either a motive for the cited combination must be provided, or the rejection must withdrawn. If a motive is provided, such would constitute a new ground for rejection not necessitated by amendment to the claims. Therefore, any further rejection of claims 1, 3, 4, and 8 must be Non-Final.

Furthermore, the combination is traversed because modification of Herndon's training process according to Suzuki is not necessary. Herndon is designed with a fixed camera, a fixed pickup area, and flat parts seen with simple part profiles. One skilled in the art would not add cost and complexity to Herndon when all that is required, for image pickup during training, is that an operator place a sample part on the backlit surface.

CLAIMS 9-12

Claim 9, for example, recites "storing a set of images of different relative orientations of a subject" and matching one of the stored images with a current image of a workpiece to determine orientation of the workpiece, which is shaped like the subject. The rejection compares the stored images to column 6, lines 26-49 of Herndon. However, in Herndon, the captured images are only used as a basis to generate and store a "statistical description of the component" (end of column 6 to start of column 7). Throughout, Herndon, for one component/subject, discusses only one silhouette/profile ("first data file is a description of **the** outline or silhouette of the component which allows matching of **a** silhouette", column 6, lines 38-40). Because the components/parts are flat parts lying prone (e.g. circuit boards), one profile or silhouette image (or statistical representation thereof) is all that is needed; whether a component has one side up or the other, the silhouette is basically the same (but flipped) and matching with the same stored silhouette is also basically the same. In sum, Herndon does not disclose storing plural images for **a** subject/component. The same argument applies to claims 1, 8, and 13. Withdrawal of the rejection of claims 1, 8, and 9-13 is respectfully requested.

Claim 9 recites storing images "captured by a plurality of robotic operations", where the set of plural captured images are used later for comparison to a working image to determine a workpiece orientation. However, image capture during training in Herndon does not involve any robotic operations. An operator simply places a component on the backlit surface, and an image is taken by a stationary camera. No robotic operations are involved.

The rejection is also traversed because there is no apparent reason why Herndon should be modified to include a current image of a workpiece being captured with a known current arrangement of an image pickup device on a robot. As discussed above, Herndon does not use robotic operations to capture *the initially stored set of images that are used later for orientation determination*. The concept of different "current arrangement(s)" of an image pickup is completely absent from Herndon.

Withdrawal of the rejection of claims 9-12 is respectfully requested.

DEPENDENT CLAIMS

The dependent claims are deemed patentable due at least to their dependence from allowable independent claims. These claims are also patentable due to their recitation of independently distinguishing features. For example, claim 5 recites that "said teaching model is generated for every direction in which said image pickup device took the image of said reference object and said teaching model is stored in association with information on the direction". This feature is not taught or suggested by the prior art. Withdrawal of the rejection of the dependent claims is respectfully requested.

CONCLUSION

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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Date: 7 Sep. 2004

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